Claims

1. An x-ray generator comprising:

a vessel for holding a low pressure gas atmosphere inside;

hemimorphic crystal supporting means provided in said vessel;

at least a pair of hemimorphic crystals supported by said hemimorphic crystal supporting means in said vessel and arranged oppositely to each other at a distance therebetween; and

a heating and cooling means for elevating and lowering the temperature of said hemimorphic crystals, wherein

x-rays are radiated from said vessel as the temperature of said hemimorphic crystals is elevated or lowered.

2. The x-ray generator according to Claim 1, wherein the walls of said vessel are formed of a material blocking x-rays and provided with at least one x-ray transmission window.

3. The x-ray generator according to Claim 1 or 2, wherein said hemimorphic crystals of each pair are arranged oppositely to each other at their oppositely charged planes and said heating and cooling means elevates and lowers the temperature of said hemimorphic crystals of each pair with the same temperature gradients and with the same periods.

4. The x-ray generator according to Claim 1 or 2, wherein said hemimorphic crystals of each pair are arranged oppositely to each other at their oppositely charged

planes and a metal target is arranged between said hemimorphic crystals of each pair and is supported by a target supporting means in said vessel.

5. The x-ray generator according to Claim 1 or 2, wherein said hemimorphic crystals of each pair are arranged oppositely to each other at their planes having charge of the same sign and said heating and cooling means elevates and lowers the temperature of said hemimorphic crystals of each pair with the same temperature gradients and with the same periods.

6. The x-ray generator according to Claim 1 or 2, wherein said hemimorphic crystals of each pair are arranged oppositely to each other at their planes having charge of the same sign and said heating and cooling means elevates and lowers the temperature of said hemimorphic crystals of each pair with the opposite temperature gradients and with the same periods.

7. An x-ray generator comprising:

a vessel for holding a low pressure gas atmosphere inside;

hemimorphic crystal supporting means arranged in said vessel;

a pair of hemimorphic crystals supported by said hemimorphic crystal supporting means in said vessel and arranged oppositely to each other at a distance therebetween, said pair of hemimorphic crystals being arranged oppositely to each other at their planes having charge of the same sign;

a metal target surrounding the space between said pair of hemimorphic crystals in said vessel and supported by a target supporting means arranged in said vessel; and

a heating and cooling means for elevating and lowering the temperature of said

hemimorphic crystals, wherein

x-rays are radiated from said vessel as the temperature of said hemimorphic crystals is elevated or lowered.

8. The x-ray generator according to Claim 7, wherein the walls of said vessel are formed of a material that does not transmit x-rays and provided with at least one x-ray transmission window.

9. The x-ray generator according to any one of Claims 1 to 8, wherein

said heating and cooling means has:

a temperature sensor for measuring the respective temperature of said hemimorphic crystals of each pair;

a heating and cooling means for repeatedly heating and cooling said hemimorphic crystals; and

a control means for controlling the operation of said heating and cooling means based on a temperature detection signal from said temperature sensor.

10. An x-ray generator comprising:

a vessel for holding a low pressure gas atmosphere inside;

hemimorphic crystal supporting means arranged in said vessel;

a pair of hemimorphic crystal aggregates supported by said hemimorphic crystal supporting means in said vessel and arranged oppositely to each other at a distance therebetween,

a heating and cooling means for elevating and lowering the temperature of said hemimorphic crystal aggregates,

said pair of hemimorphic crystal aggregates being respectively composed of a number of hemimorphic crystals supported on a base and concavely curved, all of the hemimorphic crystals constituting one of said hemimorphic crystal aggregate facing their positively charged planes toward the side apart from said base, all of the hemimorphic crystals constituting the other of said hemimorphic crystal aggregates facing their negatively charged planes toward the side apart from said base, said pair of hemimorphic crystal aggregates being arranged oppositely to each other at the concave side apart from said base thereof; and

a metal target arranged between said pair hemimorphic crystal aggregates and supported by a target supporting means in said vessel.

11. The x-ray generator according to Claim 10, wherein the walls of said vessel are formed of a material blocking x-ray transmission and provided with at least one slit-shaped x-ray transmission window positioned in the same plane, and said base has a semi-cylindrical form, and said hemimorphic crystals are arranged on the concave side of said base, and said pair of hemimorphic crystal aggregates are arranged oppositely to each other in said vessel in such a manner that the space between the aggregates in their axial direction matches said at least one slit-shaped x-ray transmission window.

12. An x-ray generator, comprising:

a vessel for holding a low pressure gas atmosphere inside, said vessel being formed of a material blocking x-ray transmission;

hemimorphic crystal supporting means arranged in said vessel;

a pair of hemimorphic crystal aggregates arranged oppositely and joined to

each other through a dielectric material, and supported by said hemimorphic crystal supporting means in said vessel,

a heating and cooling means for elevating and lowering the temperature of said hemimorphic crystal aggregates,

said pair of hemimorphic crystal aggregates being respectively composed of a number of hemimorphic crystals supported on the concave side of hemispherical shell-shaped bases, all of the hemimorphic crystals constituting one of hemimorphic crystal aggregate facing their positively charged planes toward the side apart from said base, all of the hemimorphic crystals constituting the other of said hemimorphic crystal aggregate facing their negatively charged planes toward the side apart from said base, said pair of hemimorphic crystal aggregates being arranged oppositely to each other at the concave side apart from said base thereof and joined to each other through a ring-shaped dielectric material so as to form a spherical shell; and

a metal target supported by a target supporting means in said spherical shell at a position including the center of said spherical shell, at least one of said pair of hemimorphic crystal aggregates being provided with at least one through hole, a wall of said vessel being provided with an x-ray transmission window aligning with said through hole.

13. An ozone generator, comprising:

a low pressure gas sealing housing;

a hemimorphic crystal arranged in said housing;

a heating and cooling means for repeatedly heating and cooling said hemimorphic crystal arranged in said housing; and

a vessel for a material gas for generating ozone, said vessel being arranged

adjacently to the outside or inside of said housing, said vessel for a material gas for generating ozone being irradiated with soft x-rays generated from said hemimorphic crystal through an x-ray transmission window.

14. The ozone generator according to Claim 13, wherein an x-ray target is arranged in the low pressure gas sealing housing, and soft x-rays and charged particle beams generated from the hemimorphic crystal are projected to said x-ray target, and thereby, said vessel for a material gas for generating ozone is irradiated with secondary x-rays generated from the target.

15. The ozone generator according to Claim 13 or 14, wherein a hollow cathode is arranged around the hemimorphic crystal.

16. The ozone generator according to Claim 13 or 14, wherein at least two hemimorphic crystals are arranged oppositely to each other at a space therebetween in said low pressure gas sealing housing, and a heating and cooling means is provided to each of said hemimorphic crystals, and a ring-shaped ozonization chamber is arranged at the side of the space between said hemimorphic crystals opposed to each other, whereby the respective hemimorphic crystals are periodically and thermally excited in the same phase or in opposite phases.

17. The ozone generator according to Claim 13, wherein a number of hemimorphic crystals are arranged along an arched surface, and an ozonization chamber is arranged at the center portion of said arc.

18. An ozone generation method, wherein a hemimorphic crystal is arranged in a low pressure gas sealing housing, and said hemimorphic crystal is repeatedly thermally excited in a cycle of a predetermined period of time, and thereby, soft x-rays are continuously generated from said hemimorphic crystal, and ozone is generated by irradiating a material gas for generating ozone with the x-rays.

19. An ozone generation method, wherein a hemimorphic crystal is arranged in a sealed low pressure gas housing and thermally excited, and thereby, an intensive electric field is induced so as to make charged particles and x-rays be generated from said hemimorphic crystal and projected to an x-ray target, and then, a material gas for generating ozone is irradiated with secondary x-rays excited on said target, so as to generate ozone.

20. The ozone generation method according to Claim 18 or 19, wherein a number of hemimorphic crystals are arranged oppositely to each other, and the thermal excitation cycles of the respective crystals are controlled so as to be in the same phase or in opposite phases.